

Claims

1. A method for designing ophthalmic lenses in which at least one surface among the set of refractive surfaces on the object side and eye side in the mounted state has a spherical or aspherical surface shape that is formed beforehand, and at least one refractive surface has an aspherical surface shape,

this ophthalmic lens design method being characterized in that design is performed so that the shape of the refractive surface whose shape is not formed beforehand among the set of refractive surfaces is an aspherical surface shape which is such that the aberration of the ophthalmic lens is corrected according to the laws of Donders-Listing in accordance with at least the refractive power that is necessary for refractive correction of the user or the refractive power that is necessary for astigmatic correction, or both.

2. The ophthalmic lens design method according to Claim 1, which is characterized in that an arbitrary meridian of the refractive power necessary for refractive correction of the user is taken as a standard meridian in arbitrary principal rays passing through the plane of the ophthalmic lens, and

the shape of the refractive surface whose shape is not formed beforehand is determined so that ΔP_{all} expressed by Equation (1) below shows a minimum value or a specified value or less,

where $E(\alpha)$ is the refractive power in the meridian direction that is required for the refractive correction of the eye of the user in the meridian direction at an arbitrary angle of α from the standard meridian, and $D(\alpha)$ is the refractive power in the meridian direction of the lens.

$$\Delta P_{all} = \int_a^b |\Delta P(\alpha)| d\alpha \quad \dots (1)$$

Here, $\Delta P(\alpha)$ is a function expressed as $\Delta P(\alpha) = D(\alpha) - E(\alpha)$, and a and b are values that satisfy the equation $b - a = n\pi$, where n is a natural number.

3. The ophthalmic lens design method according to Claim 1, which is characterized in that an arbitrary meridian of the refractive power necessary for refractive correction of the user is taken as a standard meridian in arbitrary principal rays passing through the plane of the ophthalmic lens, and

the shape of the refractive surface whose shape is not formed beforehand is determined so that ΔP_{av} expressed by Equation (2) below shows a minimum value or a specified value or less,

where $E(\alpha)$ is the refractive power in the meridian direction that is required for the refractive correction of the eye of the user in the meridian direction at an arbitrary angle of α from the standard meridian, and $D(\alpha)$ is the refractive power in the meridian direction of the lens.

$$\Delta P_{av} = \frac{1}{|b-a|} \int_a^b |\Delta P(\alpha)| d\alpha \quad \dots (2)$$

Here, $\Delta P(\alpha)$ is a function expressed as $\Delta P(\alpha) = D(\alpha) - E(\alpha)$, and a and b are values that satisfy the equation $b - a = n\pi$, where n is a natural number.

4. The ophthalmic lens design method according to Claim 1, which is characterized in that an arbitrary meridian of the refractive power necessary for refractive correction of the user is taken as a standard meridian in arbitrary principal rays passing through the plane of the ophthalmic lens, and

the shape of the refractive surface whose shape is not formed beforehand is determined so that at least one of the values ΔAS or ΔMP satisfying the following conditional equations shows a minimum value or a specified value or less, where ΔP_{max} is the maximum value and ΔP_{min} is the minimum value of $\Delta P'(\alpha) = D(\alpha) - E(\alpha)$ in the range of $a \leq \alpha \leq b$ or $b \leq \alpha \leq a$, with $E(\alpha)$ being the refractive power in the meridian direction that is required for the refractive correction of the eye of the user in the meridian direction at an arbitrary angle of α from the standard meridian, and $D(\alpha)$ being the refractive power in the meridian direction of the lens.

Here, $\Delta AS = |\Delta P_{max} - \Delta P_{min}| \dots (3)$

$\Delta MP = (\Delta P_{max} + \Delta P_{min})/2 \dots (4)$

and a and b are values that satisfy the equation $b - a = n\pi$, where n is an arbitrary integer excluding zero.

5. An ophthalmic lens manufacturing method which is characterized in that this method has a process which is such that in a lens in which at least one surface among the set of refractive surfaces on the object side and eye side in the mounted state is a refractive surface having a spherical or aspherical surface shape that is formed beforehand, the shape of the refractive

surface whose shape is not formed beforehand is designed in accordance with the ophthalmic lens design method according to any one of Claims 1 through 4, and the refractive surface whose shape is not formed beforehand is worked in accordance with this design data.

6. A method for manufacturing an ophthalmic lens using as an element material a semi-product ophthalmic lens in which at least one surface among the set of refractive surfaces on the object side and eye side in the mounted state is a refractive surface having a spherical or aspherical surface shape that is formed beforehand, and at least one refractive surface has an aspherical surface shape, this ophthalmic lens manufacturing method being characterized in that this method has the steps of attaching the semi-product ophthalmic lens to a shape working apparatus, and working the refractive surface of the semi-product lens whose shape has not been formed beforehand by means of the shape working apparatus on the basis of design data obtained by the method according to any of Claims 1 through 4 to produce a finished product.

7. The ophthalmic lens manufacturing method according to Claim 6, which is characterized in that the design data is determined at a different location from the location where the shape working apparatus is present, and is transmitted to the location where the shape working apparatus is present via a communication device.

8. A computer program which determines the aspherical surface shape of the refractive surface of an ophthalmic lens, this computer program being characterized in that the calculation of the refractive power $E(\alpha)$ in the meridian direction required for refractive correction of the eye of the user in the direction of a meridian at an arbitrary angle of α from the standard meridian

when an arbitrary meridian of the refractive power require for refractive correction of the user is taken as the standard meridian is performed for each arbitrary set of principal rays passing through the ophthalmic lens, the calculation of the refractive power $D(\alpha)$ in the meridian direction of the lens is performed for each arbitrary set of principal rays passing through the ophthalmic lens, and the aspherical surface shape of the refractive surface is determined on the basis of $E(\alpha)$ and $D(\alpha)$ so that the aberration of the ophthalmic lens shows a minimum value or a specified value or less in accordance with the laws of Donders-Listing.